

WHAT IS CLAIMED IS:

1. An isolated polynucleotide comprising an APAO encoding polynucleotide linked to a fumonisin esterase encoding polynucleotide, wherein the APAO encoding polynucleotide comprises a member selected from:

a) a polynucleotide encoding a polypeptide selected from SEQ ID NOS: 6, 11, 23, 33, 36, 38, 40, 42, 44, 46, 49, 51 and 53;

b) a polynucleotide having at least 70% sequence identity to a polynucleotide selected from SEQ ID NOS: 5, 10, 22, 33, 35, 37, 39, 41, 43, 45, 48, 50 and 52; and

c) a polynucleotide selected from SEQ ID NOS: 5, 10, 22, 32, 35, 37, 39, 41, 43, 45, 48, 50 and 52.

2. A recombinant expression cassette comprising a polynucleotide of claim 1 operably linked to a promoter.

3. The recombinant expression cassette of claim 2 wherein the polynucleotide is operably linked to a plant signal sequence.

4. A vector comprising the recombinant expression cassette of claim 2.

5. A host cell comprising the recombinant expression cassette of claim 2.

6. The host cell of claim 5 wherein the cell is a plant cell.

7. The host cell of claim 6 wherein the plant cell is selected from the group consisting of maize, sorghum, wheat, tomato, soybean, alfalfa, sunflower, canola, cotton, barley, millet, and rice.

8. A plant comprising a polynucleotide of claim 1.

9. A seed from a plant of claim 7.

10. An isolated polypeptide comprising a member selected from:
- a) a polypeptide comprising at least 70% sequence identity to a polypeptide selected from SEQ ID NOS: 6, 11, 23, 33, 36, 38, 40, 42, 44, 46, 49, 51 and 53;
  - b) a polypeptide encoded by a polynucleotide having at least 70% sequence identity to a polynucleotide selected from SEQ ID NOS: 5, 10, 22, 32, 35, 37, 39, 41, 43, 45, 48, 50 and 52; and
  - c) a polypeptide selected from SEQ ID NOS: 6, 11, 23, 33, 36, 38, 40, 42, 44, 46, 49, 51 and 53.
11. The polynucleotide of claim 1 wherein the fumonisin esterase encoding polynucleotide is ESP1.
12. The polynucleotide of claim 11 wherein the polynucleotide is set forth in SEQ ID NO: 24.
13. The polynucleotide of claim 1 wherein the fumonisin esterase encoding polynucleotide is BEST1.
14. The polynucleotide of claim 13 wherein the polynucleotide is set forth in SEQ ID NO: 26.
15. A method of degrading fumonisin, a structurally related mycotoxin, a fumonisin breakdown product, or a breakdown product of a structurally related mycotoxin comprising the steps of:
- a) applying an APAO enzyme as a spray or wash; and
  - b) under degradation conditions allowing sufficient time for the polypeptide to degrade the fumonisin, the structurally related mycotoxin, the fumonisin breakdown product, or the breakdown product of a structurally related mycotoxin.
16. The method of claim 15 wherein the fumonisin or structurally related mycotoxin is present in harvested grain.

17. The method of claim 15 wherein degradation occurs during processing of the harvested grain.
18. The method of claim 17 wherein the harvested grain is to be used as animal feed.
19. The method of claim 15 wherein degradation occurs in silage.
20. The method of claim 15 wherein fumonisin esterase is also added at or before step (a).
21. The method of claim 15 wherein the APAO enzyme is selected from:
- a) a polypeptide comprising at least 70% sequence identity to a polypeptide selected from SEQ ID NOS: 6, 11, 23, 33, 36, 38, 40, 42, 44, 46, 49, 51 and 53;
  - b) a polypeptide encoded by a polynucleotide having at least 70% sequence identity to a polynucleotide selected from SEQ ID NOS: 5, 10, 22, 32, 35, 37, 39, 41, 43, 45, 48, 50 and 52; and
  - c) a polypeptide selected from SEQ ID NOS: 6, 11, 23, 36, 38, 40, 42, 44, 46, 49, 51 and 53.
22. A method of identifying transformed plant cells comprising the steps of:
- a) introducing into a plant cell at least one copy of an expression cassette comprising an APAO encoding polynucleotide;
  - b) placing the plant cell on culture media containing an AP1 or a phytotoxic analog; and
  - c) identifying transformed cells as the surviving cells in the culture.
23. The method of claim 22 wherein the APAO encoding polynucleotide comprises a polynucleotide having at least 70% sequence identity to a polynucleotide selected from SEQ ID NOS: 5, 10, 22, 32, 35, 37, 39, 41, 43, 45, 48, and 50.
24. The method of claim 22 wherein a fumonisin esterase encoding polynucleotide is also introduced into the plant cell.

25. A method of detecting fumonisins or structurally related toxins, the method comprising:

- a) adding APAO enzymes to a sample containing fumonisin or a structurally related toxin;
- b) reacting the sample under conditions of time and temperature sufficient to convert the toxin to the corresponding oxidized or deaminated toxin; and
- c) detecting the hydrogen peroxide or ammonia produced.

26. The method of claim 25 wherein the APAO enzyme is encoded by a polynucleotide having at least 70% sequence identity to a polynucleotide selected from SEQ ID NOS: 5, 10, 22, 32, 35, 37, 39, 41, 43, 45, 48, and 50.

27. The method of claim 25 wherein fumonisin esterase is added at or before step (a).

28. A method of producing a plant capable of degrading fumonisin, a structurally related mycotoxin, a fumonisin breakdown product, or a breakdown product of a structurally related mycotoxin comprising the steps of:

- a) introducing into a plant cell at least one copy of an expression cassette comprising a polynucleotide encoding an APAO enzyme operably linked to a promoter; and
- b) under degradation conditions expressing the APAO enzyme for a time sufficient to degrade the fumonisin, the fumonisin breakdown product, the structurally related mycotoxin, AP1, or a breakdown product of a structurally related mycotoxin.

29. The method of claim 28 wherein a polynucleotide encoding a fumonisin esterase is also introduced.

30. The method of claim 28 wherein the APAO enzyme is encoded by a polynucleotide having at least 70% sequence identity to a polynucleotide selected from SEQ ID NOS: 5, 10, 22, 32, 35, 37, 39, 41, 43, 45, 48, 50 and 52.

31. The method of claim 28 wherein the plant cell is regenerated into a plant.
32. The method of claim 28 wherein a fumonisin esterase encoding polynucleotide is also introduced.
33. A host cell comprising an APAO encoding polynucleotide and a fumonisin esterase encoding polynucleotide.
34. The host cell of claim 33 wherein the APAO encoding polynucleotide comprises a polynucleotide having at least 70% identity to a polynucleotide selected from SEQ ID NOS: 5, 10, 22, 32, 35, 37, 39, 41, 43, 45, 48, and 50.
35. The host cell of claim 33 wherein the fumonisin esterase encoding polynucleotide is selected from ESP1 and BEST1.
36. The host cell of claim 33 wherein the cell is a plant cell.
37. The host cell of claim 36 wherein the cell is selected from maize, sorghum, wheat, tomato, soybean, alfalfa, sunflower, canola, cotton, and rice.
38. The host cell of claim 37 wherein the plant cell is regenerated into a plant.
39. A method of predicting possible mutagenesis sites on APAO comprising the steps of:
- a) developing a 3-dimensional model of APAO; and
  - b) identifying sites on APAO to mutate by evaluating the likelihood that particular amino acids could contribute to misfolding.
40. A 3-dimensional model of APAO generated by an automated modeling program.
41. The model of claim 40 wherein the automated modeling program is *Modeler*.